AEROLOGICAL OBSERVATIONS

BY L. T. SAMUELS

Free-air temperatures during January were exceptionally high at Ellendale, with the departures decreasing with increase in altitude. (See Table 1.) Positive temperature departures occurred also at Royal Center and in the lower levels at Broken Arrow. Elsewhere the departures were negative.

Free-air relative humidity departures were variable and of small magnitude at all stations. Those for vapor pressure were in agreement with the temperature departures.

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressures during January, 1931*

TEMPERATURE (° C.)

Altitude *Meters* m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	3.8	+0.6	3.8	−1.6	−5.0	+6.1	6.5	−1.5	−0.8	+3.5
500	4.8	+2.0	5.0	−0.3	−4.8	+6.2	7.0	−0.5	−1.9	+3.5
1,000	4.0	+1.3	4.0	−0.5	−1.7	+7.1	5.7	−1.6	−2.9	+2.4
1,500	2.2	−0.2	2.7	−0.3	−3.3	+4.8	4.3	−2.1	−3.9	+1.9
2,000	0.6	−0.4	0.9	−0.2	−5.9	+3.7	1.9	−2.8	−5.2	+1.6
2,500	−1.7	−0.5	−1.4	−0.4	−8.4	+3.4	0.0	−2.6	−6.9	+1.8
3,000	−4.4	−0.7	−4.2	−1.0	−10.8	+3.6	−2.5	−2.8	−9.2	+1.8
4,000	−11.4	−2.2	−10.5	−2.1	−16.9	+2.9	------	------	−15.3	−0.2
5,000	------	------	−15.8	−1.8	------	------	------	------	−22.1	------

RELATIVE HUMIDITY (%)

Surface	75	+5	77	+7	80	−1	78	+1	80	+1
500	64	0	65	+3	78	−1	61	−9	79	+5
1,000	56	+1	58	+1	63	−3	52	−9	70	+7
1,500	51	+5	52	−1	60	+1	47	−6	61	+5
2,000	41	0	48	−1	60	+2	48	0	53	+2
2,500	37	−3	45	0	58	0	47	+2	49	−3
3,000	37	−3	44	+2	55	−3	43	+2	49	−4
4,000	34	−8	49	+8	55	+1	------	------	50	−4
5,000	------	------	75	+25	------	------	------	------	54	------

TABLE 1.—*Free-air temperatures, relative humidities, and vapor pressure during January, 1931*—Continued

VAPOR PRESSURE (*mb.*)

Altitude *Meters* m. s. l.	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal
Surface	6.08	+0.40	6.17	−0.55	3.51	+1.11	7.83	−1.03	4.75	+0.94
500	5.63	+0.57	5.61	−0.44	3.47	+1.12	6.46	−1.34	4.30	+0.99
1,000	4.64	+0.44	4.61	−0.67	3.36	+1.21	5.06	−1.44	3.38	+0.59
1,500	3.54	+0.17	3.73	−0.58	2.84	+0.87	3.94	−1.29	2.57	+0.24
2,000	2.45	−0.29	2.95	−0.52	2.33	+0.63	3.34	−0.84	2.02	+0.10
2,500	1.91	−0.39	2.39	−0.30	1.77	+0.38	2.83	−0.54	1.58	−0.07
3,000	1.52	−0.43	2.00	−0.11	1.26	+0.18	2.26	−0.40	1.23	−0.21
4,000	1.12	−0.29	1.42	+0.02	0.55	−0.03	------	------	0.89	−0.12
5,000	------	------	1.31	+0.18	------	------	------	------	0.67	------

TABLE 2.—*Free-air data obtained at naval air stations during January, 1931*

Altitude (meters) m. s. l.	Temperature (° C.)				Relative humidity (%)			
	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Washington, D. C.	Hampton Roads, Va.	Pensacola, Fla.	San Diego, Calif.	Washington, D. C.
Surface	3.7	7.4	13.4	−1.4	73	80	60	73
500	3.5	7.7	13.5	−0.6	64	72	55	61
1,000	1.3	6.2	11.9	−1.6	58	64	45	56
2,000	−3.7	3.9	6.6	−5.3	52	51	40	49
3,000	−7.3	−1.0	0.6	−8.1	46	45	32	34

In Table 3 are shown the resultant free-air winds for a representative group of stations. The light resultant velocities and variable directions at the upper levels in the extreme western part of the country are conspicuous as compared with the more uniform northwesterly directions in the central and eastern sections.

TABLE 3.—*Free-air resultant winds (meters per second) based on pilot balloon observatoins made near 7 a. m. (E. S. T.) during January, 1931*

Altitude (meters) m. s. l.	Broken Arrow, Okla. (233 meters)		Brownsville, Tex. (12 meters)		Burlington, Vt. (132 meters)		Cheyenne, Wyo. (1,873 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 m.)		Groesbeck, Tex. (139 meters)		Havre, Mont. (762 meters)		Jacksonville, Fla. (14 m.)		Key West, Fla. (11 meters)		Los Angeles, Calif. (127 meters)		Medford, Oreg. (410 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	S 55 W	0.5	N 7 E	0.3	S 7 W	0.8	N 75 W	5.5	S 83 W	1.5	N 71 W	2.5	N 50 W	0.7	S 62 W	3.7	N 50 W	1.4	N 39 E	2.9	N 35 E	2.2	S 17 W	0.5
500	S 77 W	2.8	S	2.6	S 86 W	3.3	------	----	N 74 W	4.9	N 78 W	3.8	N 78 W	2.4	------	----	N 44 W	2.6	N 61 E	5.4	N 57 E	1.3	S 27 E	1.3
1,000	N 78 W	5.4	S 33 W	2.0	N 80 W	6.8	------	----	N 73 W	5.2	N 71 W	4.6	S 71 W	9.1	S 88 W	3.5	N 65 E	3.2	N 74 E	0.9	S 30 E	3.8
1,500	N 77 W	6.3	S 58 W	1.9	N 69 W	9.7	------	----	N 73 W	7.6	N 56 W	10.6	N 65 W	4.4	N 85 W	10.7	N 83 W	5.8	S 28 W	0.4	S 7 W	4.0
2,000	N 63 W	7.4	N 76 W	3.6	N 60 W	13.1	N 77 W	8.3	N 88 W	8.8	N 51 W	12.1	N 57 W	4.1	N 75 W	12.4	N 62 W	6.4	S 55 W	1.7	S 86 W	5.2
2,500	N 54 W	9.3	S 77 W	7.4	N 74 W	14.7	N 68 W	13.4	N 67 W	9.1	N 50 W	13.3	N 74 W	5.9	N 69 W	10.1	N 66 W	8.7	N 89 W	3.7	S 47 W	5.6
3,000	N 53 W	7.7	S 75 W	7.4	------	----	N 57 W	12.5	N 77 W	6.6	N 52 W	12.2	N 80 W	6.2	N 68 W	11.2	N 72 W	10.8	------	----	S 68 W	1.2	S 84 W	2.8
4,000	------	----	S 85 W	9.6	------	----	N 55 W	11.0	------	----	------	----	S 80 W	5.5	------	----	------	----	------	----	------	----	S 50 W	1.7
5,000	------	----	S 78 W	11.1	------	----	N 71 W	7.6	------	----	------	----	------	----	------	----	------	----	------	----	------	----	------	----

TABLE 3.—*Free-air resultant winds (meters per second) based on pilot balloon observations made near 7 a. m. (E. S. T.) during January, 1931*—Continued

	Memphis, Tenn. (145 meters)		Modena, Utah (1,665 meters)		New Orleans, La. (25 meters)		Omaha, Nebr. (299 meters)		Phoenix, Ariz. (356 meters)		Royal Center, Ind. (225 meters)		Salt Lake City, Utah (1,294 meters)		San Francisco, Calif. (8 meters)		Sault Ste. Marie, Mich. (198 meters)		Seattle, Wash. (14 meters)		Spokane, Wash. (606 meters)		Washington, D. C. (10 meters)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°	
Surface	S 68 W	0.9	S 81 W	2.4	N 19 E	0.9	W	0.9	S 71 E	3.7	S 63 W	2.5	S 40 E	0.7	S 77 E	0.8	N 31 E	0.5	S 46 E	1.5	S 15 E	0.8	N 53 W	1.4
500	N 79 W	4.6			N 5 W	4.1	N 70 W	3.8	S 84 E	4.2	S 87 W	7.1			N 33 E	2.0	N 66 W	1.6	S 8 W	7.0			N 67 W	7.5
1,000	N 69 W	6.1			N 29 W	4.1	N 61 W	8.5	N 82 E	3.5	N 78 W	7.7			N 30 E	1.6	N 57 W	6.3	S 18 W	8.3	S 19 W	3.5	N 67 W	9.8
1,500	N 88 W	7.1			N 53 W	4.5	N 67 W	10.3	N 80 E	2.1	N 87 W	12.4	S 16 E	1.4	N 47 W	0.8	N 48 W	9.2	S 33 W	7.7	S 51 W	7.5	N 73 W	11.5
2,000	N 83 W	7.1	N 57 E	1.9	N 69 W	4.2	N 67 W	11.7	S 73 E	1.1	N 82 W	13.4	S 11 W	3.1	N 35 W	1.7	N 53 W	12.6	S 36 W	7.1	S 65 W	8.7	N 77 W	10.3
2,500	N 85 W	10.3	N 71 E	3.2	N 70 W	3.7	N 69 W	13.0	S 16 W	0.5	N 66 W	13.6	S 41 W	2.1	N 41 W	1.9	N 54 W	14.1	S 76 W	6.9	S 66 W	10.0	S 84 W	8.9
3,000	N 87 W	11.7	N 53 E	1.5	N 61 W	3.6	N 60 W	14.8	N 69 W	0.8			N 79 W	3.0	N 30 W	1.6	N 57 W	16.0			S 68 W	9.2		
4,000			N 59 W	3.6			N 52 W	15.3	N 39 W	7.4			S 78 W	7.8	N 65 W	1.7								
5,000			N 49 W	5.5																				

TABLE 4.—*Observations by means of kites, captive and limited height sounding balloons during January, 1931*

	Broken Arrow, Okla.	Due West, S. C.	Ellendale, N. Dak.	Groesbeck, Tex.	Royal Center, Ind.
Mean altitudes, meters m. s. l., reached during month	2,823	2,640	2,997	2,561	2,895
Maximum altitude, meters m. s. l., reached	4,032	5,123	4,518	3,938	6,209
Number of flights made	31	33	29	21	28
Number of days on which flights were made	28	29	29	21	28

In addition to the above, there were approximately 176 scheduled pilot balloon observations made daily at 60 weather bureau stations in the United States.

WEATHER IN THE UNITED STATES

THE WEATHER ELEMENTS

By M. C. BENNETT

GENERAL SUMMARY

The month of January was abnormally warm and dry. However, in the extreme southern portions of the country, the more northeastern States, and the central Plateau the temperature averaged below normal. Elsewhere the month was generally warm, especially in the area between the Great Lakes and Rocky Mountains, where the monthly means were from 12° to 19° above the average.

The precipitation for the month was heavy in much of Texas, and normal or above in the Gulf section including Florida, and in the south Pacific districts and parts of Washington. Elsewhere the falls were generally scanty, with large areas continuing remarkably dry. In practically all central valley sections, and generally in the Great Plains, much of the Rocky Mountain region, and the central Plateau less than half the normal was received.

TEMPERATURE

The eastern and south-central portions of the country were experiencing moderately cool weather at the beginning of January, and in the coast districts from the Carolinas to the Rio Grande, likewise in the southern Appalachians and the lower Mississippi Valley, the low temperatures prevailed without material interruption until about the 22d. Conditions varied more in the Northeast and from the Ohio Valley northward, but the first three weeks were mainly milder than normal in these sections, expecially in the middle and western portions of the Lake region.

From the middle and upper Mississippi Valley westward over the Plains to the Rocky Mountains decidedly mild weather prevailed during the first three weeks, except for a brief cold period about the 12th to 14th. West of the divide there was usually warm weather in the Pacific States, but cold weather in a large part of the Plateau region.

The last 10 days of January were unseasonably warm in most districts, only a small area centering in northern Utah and a larger area covering nearly all of New York and New England, having colder weather than normal. Remarkably high temperatures for January were noted from the North Pacific States to Lake Superior and over the Plains and the central valleys. New high marks for January were noted at several stations during the last five days of the month.

The month resembled December just before it, being far warmer than normal in the north-central portion of the country and cooler than normal in the Southeast and in large portions of the Rio Grande Valley and the Plateau. Unlike December, January was warmer than normal in the Middle Atlantic States, the Ohio Valley, northern and central Texas, nearly all of Colorado, Nevada, and Idaho, and practically every part of the Pacific States. Only Utah and Florida sections averaged more than 2° colder than normal. Minnesota and the Dakotas averaged 13° to 15° warmer than normal, and over most North-central States this was the warmest January of record, or the warmest save 1880.

In California and Florida the highest temperatures came during the first week, but in almost every other State during the closing week. The lowest marks in the far West came during the opening decade, but from the Plains southeastward to the south Atlantic coast very near the middle of the month.

PRECIPITATION

The first eight days brought much precipitation in the Pacific States, and about the 11th there was considerable in Texas. The east Gulf and Atlantic regions received important amounts about the 5th, and substantially all their month's supply during the period from the 4th to the 18th. For almost all the country the last fortnight of January was without important precipitation.